What is claimed is:

1. An apparatus for thermally processing a region of a substrate, comprising along an axis:

a continuous radiation source capable of providing a continuous first radiation beam with a first intensity profile and a wavelength capable of heating the substrate region;

an optical system adapted to receive the first radiation beam and form a second radiation beam therefrom that forms an image at the substrate; and

a stage adapted to support the substrate;

wherein at least one of the optical system and the stage is adapted to scan the image with respect to the substrate in a scan direction to heat the region with a pulse of radiation to a temperature sufficient to thermally process the region.

2. The apparatus of claim 1 wherein the image is a line image.

3. The apparatus of claim 1 wherein the optical system includes one or more curved mirrors.

4. The apparatus of claim 3 wherein the one or more curved mirrors includes a conical mirror.

5. The apparatus of claim 4 further including a plurality of conical mirrors each having a different cone angle and selectively positionable in and removable from the first radiation beam to form different sized line images.

6. The apparatus of claim 3 wherein the first radiation beam has a size, and wherein the one or more mirrors include two or more pairs of parabolic cylindrical mirrors of opposite power arranged in the first radiation beam to change the size and direction of the first radiation beam.

7. The apparatus of claim 6 wherein the cylindrical parabolic mirrors are selectively positionable in and removable from the first radiation beam to alter the size of the first radiation beam.

8. The apparatus of claim 1 further including a beam converter arranged downstream of the radiation source so as to receive the first radiation beam and convert the first intensity profile to a second intensity profile.

9. The apparatus of claim 8 wherein the beam converter and the optical system are combined in a single converter/optical system.

10. The apparatus of claim 8 wherein the first intensity profile is Gaussian.

11. The apparatus of claim 8 wherein the second profile is substantially uniform in a direction perpendicular to the scan direction.

12. The apparatus of claim 1 wherein the continuous radiation source is a laser.

13. The apparatus of claim 12 wherein the laser is a CO_2 laser.

14. The apparatus of claim 13 wherein the wavelength is between about 9.4 microns and about 10.8 microns.

15. The apparatus of claim 1 further including a stage controller coupled to the stage.

16. The apparatus of claim 15 further including a controller coupled to at least one of the radiation source, the optical system and the stage controller.

17. The apparatus of claim 1 further including one or more of the following:

an adjustable attenuator arranged downstream of the radiation source;

a quarter waveplate arranged downstream of the radiation source;

a fold mirror arranged downstream of the radiation source;

a pre-aligner in communication with the substrate stage and adapted to receive the substrate and align the substrate to a reference position;

a monitor arranged adjacent the stage and positioned to receive and measure radiation reflected from the substrate;

a diagnostic system arranged adjacent the stage and positioned to receive and measure radiation emitted from the substrate;

a beam energy monitoring system arranged downstream of the radiation source to measure the energy in one of the first and second radiation beams; and

an image monitoring system arranged to measure an intensity profile of the image.

18. The apparatus of claim 17 wherein the apparatus includes the fold mirror and the fold mirror is movable to scan the image over the substrate.

19. The apparatus of claim 17 wherein the apparatus includes the attenuator, and the attenuator includes an adjustable polarizer.

20. The apparatus of claim 17 wherein the apparatus includes the diagnostic system, and wherein the diagnostic system includes first and second detectors adapted to detect respective first and second spectral bands of the radiation emitted from the substrate to ascertain a maximum temperature of the substrate.

21. The apparatus of claim 1 wherein the optical system includes a scanning mirror adapted to scan the image over the region of the substrate.

22. The apparatus of claim 1 wherein the first radiation beam is polarized.

23. The apparatus of claim 22 wherein the polarization is circular.

24. The apparatus of claim 1 wherein the axis forms an incident angle φ with a normal to substrate surface, and wherein $0° \leq \varphi < 90°$.

25. The apparatus of claim 24 wherein the incident angle φ is equal to or near to Brewster's angle, and wherein the second radiation beam is p-polarized relative to the substrate.

26. The apparatus of claim 24 wherein the substrate is a monocrystalline semiconductor, and the incident angle φ is between 65° and 80°.

27. The apparatus of claim 1 wherein the substrate includes a grid pattern, and wherein the image is oriented at a 45° angle with respect to the grid pattern.

28. A method of thermally processing one or more regions of a substrate, comprising the steps of:

a. generating a continuous beam of radiation having a wavelength capable of heating the region; and

b. scanning the radiation over the one or more regions in a scan direction so that each point in the one or more regions receives an amount of thermal energy capable of processing each of the one or more regions.

29. The method of claim 28 wherein the substrate is monocrystalline and step b. is performed such that the image has a dwell-time over each point in the one or more regions of between a microsecond and a millisecond.

30. The method of claim 29 wherein the one or more regions include integrated circuits and the radiation of step b. forms an image having a dimension perpendicular to the scan direction of 1cm or less.

31. The method of claim 28 wherein:
the continuous beam of radiation has a first profile and
further includes the step of:

c. modifying the beam of radiation to form a second profile.

32. The method of claim 31 wherein step c. modifies the beam of radiation such that the second profile forms an image having a substantially uniform intensity at the substrate.

33. The method of claim 28 further includes the step of:

c. attenuating the beam of radiation to maintain the one or more regions at a select temperature.

34. The method of claim 28 wherein:
the continuous beam of radiation has output power; and
further includes the step of:

c. varying the output power to maintain the one or more regions at a select temperature.

35. The method of claim 28 further includes the step of:

c. forming a line image.

36. The method of claim 35 further includes the step of:

d. aligning a long dimension of the line image relative to a plane defined by axes associated with incident and reflected beams of radiation.

37. The method of claim 35 further includes the step of:

d. forming the line image by reflecting the beam of radiation from a cone-shaped mirror.

38. The method claim 35 wherein:

the line image has a length L1 and a width L2; and

further includes the step of:

d. varying at least one of the length and width.

39. The method of claim 28 further includes the step of:

c. measuring radiation reflected from the substrate region.

40. The method of claim 28 further includes the step of:

c. measuring the temperature of the substrate region.

41. The method of claim 40 wherein step c. includes the step of:

i. measuring radiation emitted from the substrate in two different spectral bands

42. The method of claim 40 further includes the steps of:

d. imaging a common region of the substrate in different spectral bands with respective detector arrays; and

e. comparing respective output signals from the detector arrays to determine a hottest point in the common region and a temperature of the hottest point.

43 The method of claim 28 wherein the beam of radiation is polarized.

44. The method of claim 43 further includes the step of:

c. rotating the polarization of the beam of radiation by one-quarter wavelength.

45. The method of claim 43 further includes the step of:

c. altering the polarization of a first beam of radiation to form a circularly polarized beam of radiation.

46. The method of claim 28 wherein:

the beam of radiation is p-polarized with respect to the substrate; and

further includes the step of:

c. irradiating the substrate with the beam of radiation at an angle equal to or near Brewster's angle.

47. The method of claim 28 wherein:

the substrate is a monocrystalline semiconductor;

the beam of radiation is p-polarized; and

further includes the step of:

c. irradiating the substrate with the beam of radiation at an incident angle of between 65° and 80°.

48. The method of claim 28 wherein step b. is performed in one of a boustrophedonic pattern, a spiral pattern, and an alternating raster pattern.

49. The method of claim 28 further includes the step of:

c. varying the polarization of a first beam of radiation to maintain the substrate at a select temperature.

50. The method of claim 28 wherein step b. is performed at a varying speed to maintain the substrate at a select temperature.

51. The method of claim 28 wherein the wavelength of the first beam of radiation is between 9.4 and 10.8 microns inclusive.

52. The method of claim 28 wherein step b., to minimize variations in radiation reflected from the substrate, includes the steps of:

i. scanning the beam of continuous radiation over the substrate;

ii. measuring a variation in the reflected radiation over a range of incident angles of a continuous first beam of radiation to determine an optimum incident angle corresponding to a least variation in the amount of reflected radiation; and

iii. scanning at or near the optimum incident angle to thermally process the one or more regions.

53. The method of claim 28 wherein step b., to minimize variations in maximum temperature produced on the substrate, includes the steps or:

i. forming an image from the continuous beam of radiation;

ii. scanning the image over the substrate;

iii. measuring a variation in maximum temperature produced at different locations on the substrate for each incident angle over a range of incidence angles to determine an optimum incident angle corresponding to the least amount of maximum temperature variation; and

iv. scanning at or near the optimum angle to thermally process the one or more regions.

54. The method of claim 28 wherein:

the substrate is crystalline; and

step b. scans the image in a direction that minimizes the formation of slip planes in the substrate.

55. The method of claim 54 wherein:

the substrate has crystal axes; and

step b. scans the image in a direction along one of the crystal axes.

56. The method of claim 28 wherein:

the one or more regions include patterned features; and

further includes the steps of:

c. forming a line image with the continuous beam of radiation; and

d. irradiating the substrate with the continuous radiation beam at an incident angle and with the line image at an image angle relative to the patterned features.

57. The method of claim 56, wherein the incident angle and image angle are

selected to minimize temperature variations over the one or more regions.

58. The method of claim 57 wherein:
the substrate is crystalline; and
further includes the step of:

e. selecting the scan direction to minimize the formation of slip planes in the substrate.